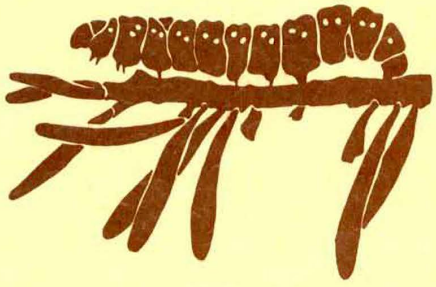
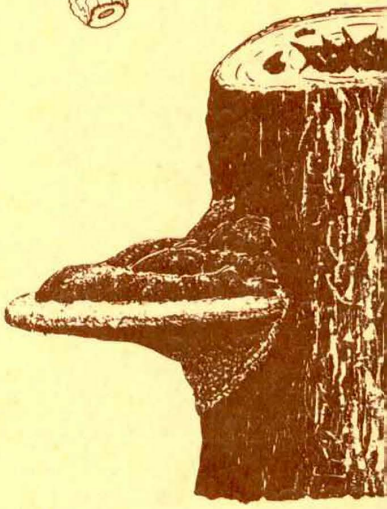
IDAHO FOREST INSECT and DISEASE REPORT





DEPT. OF LANDS

CONTROL OF THE WESTERN PINE SHOOT BORER

Eucosma sonomana Kearfott

IN SELECTED PONDEROSA PINE PLANTATIONS

IN NORTHERN IDAHO AND WESTERN MONTANA

Progress Report No. 1

by

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INTRODUCTION

In 1968, the Inland Empire Tree Improvement Cooperative composed of federal and state agencies, private forest industry, universities and tribal councils initiated a program aimed at producing ponderosa pine with superior growth characteristics. Their study is utilizing the best progenies from natural populations within the northern Rocky Mountain/Inland Empire area. Performance of trees from selected stands and of tree families within those stands is being tested in a series of progeny plantings. Eight of these were established in 1974. They were divided into two groups: four in Montana and four in Idaho/Washington. Each plantation included all selected families from the most local stands, and bulk stand lots from throughout the Inland Empire. Two seedling seed orchards were also established in 1974.

Determination of superior qualities is being made principally through height growth measurements (Fins 1984). Maximum care is being taken at each plantation to protect the test trees from external influences such as cattle, wild game, competing vegetation and insect pests, which might affect their growth potential.

In recent years a moth, the Western Pine-shoot Borer, Eucosma sonomana Kearfott, has been determined to be an important forest pest of ponderosa pine, especially in plantations. It attacks new shoots, (terminals and laterals) during elongation, stunting their growth and sometimes deforming or occasionally killing them. Growth of the attacked terminal shoot is often markedly reduced. Stoszek (1973) first described serious damage to ponderosa pine in southern Oregon. On a site with 70% of the stems infested by the shoot borer, he estimated a loss of 22% of the volume expected in borer-free conditions.

This moth has one generation per year. Eggs are layed on the elongating shoots early in the spring. The larvae chew their way into the pith and then bore through it as they feed. After completing development, the larva chews an exit hole and drops to the ground to pupate in the litter near the base of the tree. The following spring, newly emerged adults mate and lay eggs on the buds that will provide the new year's growth (Stoszek 1973; Luther 1980).

Typical symptoms of attack are:

a. The needles in the distal portion of the attacked shoot are usually shorter and more densely spaced than those in the proximal portion producing a somewhat triangular profile of the needles.

b. Disproportionate length of the lateral branches in relation to the terminal, i.e., growth of the lateral branches will be as long or longer than that of the terminal for the year of attack.

c. A spindle shaped swelling of the middle portion of the shoot, usually associated with the point of exit of the mature larva.

d. Pitch oozing at the site of emergence of the mature larvae.

In order to avoid height growth loss caused by the Western pine-shoot borer in the progeny test plantations, a decision was made to initiate control efforts. Traditional chemical control has not been effective because of the shoot borer's internal feeding habits (Stevens and Jennings 1977). The use of synthetic sex attractants (pheromones) to disrupt mating has been shown to be an effective method for controlling this insect (Sartwell et al. 1980; Sower et al. 1982; Sartwell et al. 1983; Overhulser et al. 1980). Successful control efforts have utilized both hand applied and aerially applied pheromone releasers to disrupt mating. A hand-applied treatment was selected for the control effort. It was applied in three progeny plantations in northern Idaho (Lone Mountain owned by the U.S. Forest Service, the Tensed Plantation owned by the Idaho Department of Lands, and Meadow Creek owned by the U.S. Forest Service) and a seed orchard owned by the State of Montana at Missoula. The treatments are planned to be continued through 1985 when the next regularly scheduled height growth measurements will be made.

MATERIALS AND METHODS

Materials: The treatments were conducted with Hercon "Luretape" containing Phillips Petroleum Co. pheromone in a 2:3 mixture of Z-9 and E-9 dodecenyl acetate, formulated into a plastic sandwich. The plastic was cut into strips, 1/4 inch wide by 2 feet long, each containing 30 milligrams of pheromone per square inch. This formulation of pheromone was utilized as opposed to the commonly used natural blend of a 4:1 mixture of the stereoisomers (Sower et al. 1979) as it was less expensive.

Application: The desired nominal dosage was 7.2 grams per acre applied from the ground using the strips placed on a ten meter grid, with one strip per station. In practice, the strips were tied on every fourth tree, being hand-tied on a branch at eye level with a simple overhand knot. Where there was a gap in the line of trees, the next closest tree was utilized for placement of the pheromone strip. Due to the ten foot spacing of the trees, the actual applied dosage was 4.9 grams per acre. Treatment dates were as follows:

Lone Mountain: 29 March 1983
Tensed: 30 March 1983
Meadow Creek: 30 March 1983
State of Montana Seed Orchard: 29 March 1983

Monitoring Flight: Pheromone baited traps were used in the Lone Mountain and Tensed plantations to monitor flight of the western pine shoot borer to determine if moths were present prior to treatment.

Pheromome Emission Rate: In order to determine the rate of emission of the pheromone from the pheromone strips, two reference sets were prepared, one for use in Montana and one for use in Idaho. Each set contained 20 pheromone strips. At the outset of the project, four strips from each set were wrapped in aluminum foil, labeled and stored in a freezer. The other 16 were tied on pine trees adjacent to or near the treatment area. They were tied in the same manner as the normal treatment strips, four at each cardinal direction. They were tied so the strips did not touch each other. One set of four strips (one from each cardinal direction) was collected at two-week intervals. As each set was collected, it was labeled with the date, wrapped in foil and placed in

the freezer for storage.

When the last set of strips was retrieved, all sets were packaged and sent to the Pacific Northwest Forest and Range Experiment Station at Corvallis, Oregon, for analysis and determination of the pheromone elusion rate. The analysis was conducted by extracting the residual pheromone isomers from two 1.5 mm pieces, cut from each strip at 1/3 and 2/3 of its length. Distilled hexane was used for the extraction. A 20% solution of the extract was analyzed with a Hewlett Packard 5880A flame ionization gas diromatograph using a 29-m DB1701 fused silica capillary column. Pheromone content of the samples was compared with known quantities of the (Z)-9 and (E)-9 isomers.

Evaluation: Treatment evaluation was by comparison of pre- and post-treatment infestation levels of the terminals of the host trees. The 1982 pre-treatment attacks were counted at the time of the placement of the Luretape strips in March. The post-treatment 1983 attacks were counted late in the summer after the new growth had completed development. The pre- and post-treatment evaluation of each plantation was done by the same person. The field evaluation consisted of counting the number of trees with attacked terminals (judged by looking for the symptoms previously described) and the number of trees that were not attacked. For this evaluation we did not consider or count attacks on lateral branches.

The Lone Mountain Plantation was divided into two sections for the evaluation. Section A (table 2) is most subject to invasion being bordered on the north by an untreated natural ponderosa pine stand. Both areas are bordered on the west by a western white pine plantation and on the east by a 300-foot wide strip of scattered pole and sawlog size ponderosa pine. Section B is bordered on the south by a large open field.

RESULTS and DISCUSSION

Emission Rate: Table 1 shows the residual pheromone in the Hercon dispensers after exposure in the field. The data from the two reference sets, one from Montana and one from Idaho, are averaged in the table as the results from both locations were very similar.

Table 1.--Amount of isomers and total attractant left in the Hercon Luretape dispensers with Phillips Petroleum perhomone, by duration of field exposure. 1983. Averaged for two groups of reference strips.

Exposure (Weeks)	Residual Active Chemical (mg/dispenser)		
	Z - 9	E - 9	Total
0	84.6	115.5	200.1
2	74.8	105.7	180.5
4	55.1	84.6	139.7
6	47.2	74.9	122.1
8	35.9	56.8	92.7

Table 2 shows a summary of the pre- and post-treatment infestation percentages.

Table 2.--Results of a 1983 pheromone treatment for disruption of mating by Eucosma in Idaho and Montana

Plantation	Damaged Terminals		Apparent Damage (%) Reduction (Pre-post)
	Pre-treatment # : %	Post-treatment # : %	
Lone Mtn A.	2563:61.8%	1006:24.3%	37.5
B.	645:49.3%	260:19.5%	29.8
Combined	3208:58.8%	1266:23.2%	35.6
Tensed *	1495:50.9%	861:14.7%	36.2
Meadow Creek	1314:36.5%	1144:32.3%	4.2
Montana State	987:35.0%	844:30.0%	5.0%

* 1/2 of plantation surveyed for pre-treatment count.

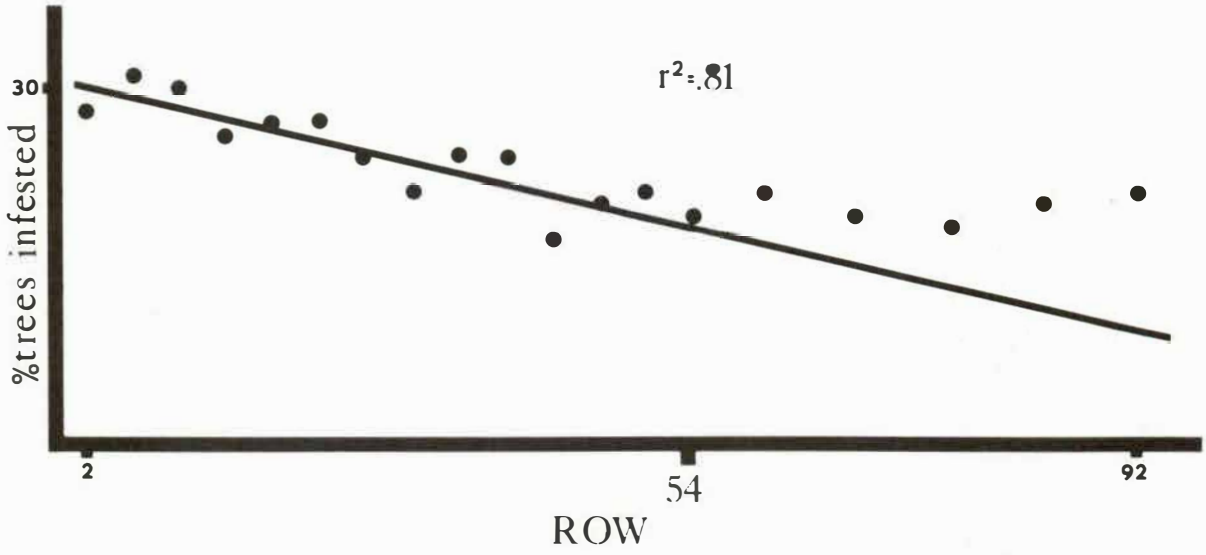
The Lone Mountain and Tensed Plantations showed definite reduction in attacks, presumably due to our 1983 treatment. The number of damaged terminals dropped by 35.6% at Lone Mountain and by 36.2% at Tensed. Sartwell and others (1980) obtained 83% and 84.2% control in a similar test conducted in Oregon. A possible reason for the difference is that in the Oregon work only about 21% of the trees were infested, where our areas averaged 44.7% with the Lone Mountain plantation having 58.8% infested. Thus, the total number of moths was apparently greater in Idaho and Montana along with the chances for successful mating and attack.

The treatments at Meadow Creek and the Montana State Nursery did not produce as much reduction in the attacks, being 4.2 and 5.0% respectively. In evaluating the project, we have two ideas that may explain our results. First, our pheromone traps showed that moth flight had occurred at the Tensed site at least 6 days before we placed our pheromone strips (16 males in five traps). Thus, some mating could have already occurred and the females would have been able to lay fertilized eggs. While we did not have monitoring traps at Meadow Creek, the same situation could have occurred at that site. The general success of the treatment at Tensed suggests that the pheromone strips were placed before the females emerged but the same may not have been true at Meadow Creek.

The second situation is that the Meadow Creek Plantation is surrounded by hundreds of acres of susceptible ponderosa pine plantations and second growth stands. This could provide a large number of fertilized females having the

potential to fly into the treated plantation to deposit eggs. The problem of invasion from untreated stands appears to be reflected in the data from Lone Mountain where the area most remote from an untreated stand (Area B) had both the lowest pre- and post-treatment infestation levels (Table 2). Figure 1 shows a steady decline in the infestation rate progressing away from the untreated natural stand. In a comparison of the percentage of trees infested correlated with the distance away from the untreated area, the best coefficient of determination (r^2=.81) was obtained using linear regression to row 54 (approximately 540 feet). Beyond this the relationship does not hold constant. This same trend was also noticed in the evaluations of the Tensed and Meadow Creek sites, with an apparent progression of lessening attacks as the evaluator moved away from the outside border, into the plantation.

Figure 1.--Lone Mountain Plantation. Relationship of infestation rate (percent trees attacked) to distance (as reflected by row number) away from the untreated area. The untreated stand providing a population of moths for invasion is across a county road from row #1. Post-treatment data.



To try to alleviate these problems, remedial ideas have been incorporated into the 1984 treatments, i.e., in 1984 we placed flight monitoring traps in all plantations very early in the season to monitor adult emergence. Also, the pheromone strips were placed in the plantations earlier in the year, and we have treated a buffer zone around those plantations treated in 1983 where there was a surrounding or adjacent ponderosa pine stand.

In 1984, we are also doing side-by-side tests of the natural blend of pheromone, comparing it with the Phillips blend used in 1983. The natural blend has been shown to be very effective in reducing attacks (Sartwell et al. 1980, 1983) but is much more costly, at $51.50 per acre projected cost for 1984, versus $17.50 per acre for the Phillips blend. With this great difference we want to compare the efficacy of the two formulations.

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